

## XVII. NOTES ON CRUSTACEA DECAPODA IN THE INDIAN MUSEUM.

### XI. ATYIDAE OF THE GENUS *PARATYA* (=XIPHOCARIDINA).

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Bouvier has shown that the West Indian *Xiphocaris elongata* (Guérin) differs in several important structural characters from the species, previously referred to the same genus, found in Eastern Asia, Australia and New Zealand and has proposed for the latter the generic name *Xiphocaridina*. But Miers in 1882, when recording certain Japanese Atyids as *Atyephyra*? *compressa*, noted that the species was probably to be distinguished generically from Brito-Capello's *Atyaephyra* by the presence of exopods on all five thoracic legs<sup>1</sup>; and he suggested for the Japanese form the generic name *Paratya*. There can be no doubt that Miers' specimens are generically identical with those on which Bouvier based his *Xiphocaridina* with the result that the latter name, by far the more appropriate of the two, must lapse.

#### Genus *Paratya*, Miers.

1868. *Atyephyra*, von Martens, *Arch. f. Naturgesch.*, XXXIV, p. 51 (in part : not *Atyaephyra*, Brito-Capello).  
1880. *Miersia*, Kingsley, *Proc. Acad. Sci. Philadelphia*, 1879, p. 416 (in part).<sup>2</sup>  
1882. *Paratya*, Miers, *Ann. Mag. Nat. Hist.* (5) IX, p. 194.  
1895. *Xiphocaris*, Ortmann, *Proc. Acad. Sci. Philadelphia*, 1894, p. 400 (in part).  
1905. *Xiphocaris*, Bouvier, *Ann. Sci. France Belgique*, XXXIX, p. 60 (in part).  
1909. *Xiphocaridina*, Bouvier, *Comptes Rendus Acad. Sci., Paris*, p. 1729.  
1912. *Xiphocaridina*, Kemp, *Rec. Ind. Mus.*, VII, p. 113.

Only two species which can be referred to the genus *Paratya* have hitherto been recognised, viz. *Paratya compressa* (de Haan), described from Japan and since recorded from Korea, Flores, Australia and Norfolk I. and *P. curvirostris* (Heller) from New Zealand, Chatham I. and Upper Assam.

<sup>1</sup> Miers was evidently unaware that von Martens in 1872 (*Arch. f. Naturgesch.*, XXXVIII, i, p. 139) had founded the genus *Xiphocaris* on this very character. *Xiphocaris*, however, was based on specimens from the West Indies and, as Bouvier has shown, is distinguished from the Pacific genus by the greater number of branchiae and other important characters.

<sup>2</sup> The type of this genus is Risso's *Ephyra pelagica*, probably a Hoplophorid.

In the collection recently made by Dr. Annandale in the Far East there are series of *P. compressa* from several localities in Japan. On examination, the specimens were found to fall into two well-marked races, one inhabiting the north-eastern portions of the main island, while the other is apparently restricted to the south-western parts, the upper limit of its distribution being Lake Biwa and its vicinity. This rather unexpected discovery led me to make an examination of all the *Paratya* preserved in the Indian Museum, and I find as a result that there has been a great deal of misapprehension regarding the taxonomy and distribution of the species. The Indian Museum is fortunately well supplied with material: including Dr. Annandale's collection, specimens are available from seven localities in Japan, from Sydney in New South Wales, from Lake Torrens in S. Australia (as well as a sample from "S. Australian waters"), from both east and west sides of Norfolk I., from two localities in New Zealand and from two in Upper Assam.

Examination of this extensive material leads me to conclude (i) that the true *Paratya compressa* is restricted to Japan, possibly extending into Korea; in the main island of the former country it is represented by two well-marked races; (ii) that the Australian form is to be distinguished specifically from the Japanese and is represented in Norfolk I. by a race which differs from it in characters of at least subspecific value; and (iii) that the form recorded from New Zealand and Upper Assam is distinct from any of the others.

The five forms examined may be distinguished by the following characteristics:—

Key to the species and subspecies of *Paratya*.

- I. Propodus of 3rd and 5th peraeopods, in both sexes, less than three times as long as dactylus,<sup>1</sup> dactylus of 3rd pair with 19 to 30 spines,<sup>2</sup> the number very rarely falling to 18 [propodus of 3rd and 4th pairs expanded distally in male, the dilated portion bearing numerous spines].
  - A. Rostrum with 16 to 25 dorsal teeth; hindmost tooth situated on carapace or immediately above orbital notch ... .. *P. compressa* (de Haan).
  - B. Rostrum with 7 to 18 dorsal teeth; proximal part of rostrum unarmed, no tooth on carapace or above orbital notch ... .. *P. compressa*, subsp. *improvisa*, nov.
- II. Propodus of 3rd and 5th peraeopods, in females,<sup>3</sup> more than three times as long as dactylus; dactylus of 3rd pair usually with 6 to 13 spines, the number occasionally rising, in males only, to 18.

<sup>1</sup> The extreme length of the dactylus, terminal spine included.

<sup>2</sup> Including the terminal spine.

<sup>3</sup> The character is also valid for males of *P. australiensis* and its subspecies; in males of *P. curvirostris* the proportion occasionally falls as low as 2.5.

- A. Upper border of rostrum with 10 to 17 irregularly disposed teeth, forming at least three distinct groups; propodus of 3rd and 4th legs expanded distally in males, the dilated portion bearing numerous spines ... .. *P. curvirostris* (Heller).
- B. Upper border of rostrum with 19 to 32 teeth, forming an uninterrupted series; 3rd and 4th legs of male not modified.
1. Carpus of 1st peraeopods twice or more than twice as long as broad; propodus of 5th peraeopods less than four times as long as dactylus; dactyli of 3rd and 5th peraeopods at least three times as long as broad,<sup>1</sup> dactylus of 3rd peraeopod with 9 to 13 spines ... .. *P. australiensis*, sp. nov.
  2. Carpus of 1st peraeopods less than twice as long as broad; propodus of 5th peraeopods, at least in females, more than four times as long as dactylus; dactyli of 3rd and 5th peraeopods less than three times as long as broad; dactylus of 3rd peraeopod with 6 to 8, rarely 9 spines ... .. *P. australiensis*, subsp. *norfolkensis*, nov.

It is probable that the size of the eggs will afford a valuable criterion in specific and subspecific differentiation; but unfortunately the collection contains ovigerous females only of *P. curvirostris* and of *P. compressa* subsp. *improvisa*.

It will be noticed that in three of the five recognised forms the third and fourth peraeopods of the male are modified, the propodus being conspicuously dilated towards its distal end and armed on the posterior margin of the expanded part with a great number of short spines. Very similar sexual differences are met with in *Atyaephyra*, a genus that has a circum-Mediterranean distribution and is also one of the more primitive genera of the family. In males of *Atyaephyra desmaresti*, as Barrois has shown,<sup>2</sup> the third and fourth legs are modified on precisely the same lines as in *Paratya*; but, strangely enough, the segment concerned is not the propodus, but the merus.

That sexual modifications of the third and fourth legs should be entirely absent in the forms of *Paratya* from Australia and Norfolk I. is very curious. Males are unfortunately scarce in my material from these localities and examination of further specimens is therefore desirable. In no case, however, have I found the slightest trace of modification, though the character is well marked in much smaller specimens from Japan.

Calman<sup>3</sup> has noticed sexual differences in the length of the spines on the third and fourth legs in *Limnocaridina similis* and *L. socius* from Lake Tanganyika, while in other species of the same

<sup>1</sup> Excluding all spines, both terminal and lateral.

<sup>2</sup> Barrois, *Rev. Biol. Nord. France*, V, p. 124, fig. 2 (1892).

<sup>3</sup> Calman, *Proc. Zool. Soc. London*, 1906, p. 195.

genus no such distinction was to be found. It seems probable, therefore, that in this genus, as in *Paratya*, the existence of sexual modifications in the thoracic legs is a specific character. In *Xiphocaris*, the most primitive of all the Atyidae, these sexual differences do not exist.<sup>1</sup>

Bouvier,<sup>2</sup> in his account of the races of *Atyaephyra desmaresti*, found that distinctive characters were afforded by the structure of the endopodite of the first pleopod of the male. In the genus *Paratya* the appendage is similar in outline in all the forms and the differences that exist in the spinulation appear to be of less importance than those derived from other parts.

All the species and subspecies examined agree in the possession of a supraorbital spine. The carpus of the first peraeopod is deeply excavate in front, that of the second pair less markedly so. Exopods are found on all the thoracic legs, but there are no arthrobranchs above the bases of any of these limbs. The outer uropod agrees with that of *Xiphocaris* in bearing only a single movable spinule in place of the series found in most genera of the family. The telson bears two, less commonly three pairs of dorsal spines and is provided at the apex with eight or ten spinules.

A synopsis of the numbers of rostral teeth in the different forms is given on p. 297.

In the descriptions which follow I have referred only to the characters that show racial or specific differences.

### *Paratya compressa* (de Haan) *sensu stricto*.

- 1849. ? *Ephyra compressa*, de Haan, in Siebold's *Fauna Japonica*, Crust., p. 186, pl. xlv, fig. 7.
- 1880. *Miersia compressa*, Kingsley, *Proc. Acad. Sci. Philadelphia*, 1879, p. 416.
- 1902. *Xiphocaris compressa*, Rathbun, *Proc. U.S. Nat. Mus.*, XXVI, p. 49 (? part only).
- 1905. *Xiphocaris compressa*, Bouvier, *Bull. Sci. France Belgique*, XXXIX, p. 62 (part only; not fig. 1, p. 61).
- 1914. *Xiphocaridina compressa*, Balss., *Abhandl. math.-phys. Klasse K. Bayer. Akad. Wiss.*, Suppl. Bd. II, Abt. 10, p. 23 (part only).

In this form the rostrum always reaches beyond the antennular peduncle, extending almost to, or a little beyond the apex of the antennal scale. On its upper border it is armed with 16 to 25 (usually 17 to 24) teeth, forming an uninterrupted series from the base to the apex. The hindmost dorsal tooth is either situated on the carapace or is placed immediately above the posterior limit of the orbit; in a few cases two posterior teeth are on the carapace. The lower border bears in the middle of its length from 1 to 6 teeth, most commonly 1 to 3.

The lateral process of the antennular peduncle extends a little beyond the end of the basal segment.

<sup>1</sup> This statement is based on an examination of a few specimens from Havana in Cuba, preserved in the Indian Museum.

<sup>2</sup> Bouvier, *Bull. Mus. d'Hist. nat. Paris*, 1913, p. 65.



## DORSAL TEETH.

Number of teeth.	NUMBER OF SPECIMENS.				
	<i>P. compressa.</i>		<i>P. curvirostris.</i>	<i>P. australiensis.</i>	
	typical form.	subsp. <i>improvisa.</i>		typical form.	subsp. <i>norfolkensis.</i>
7	...	1			
8	...	5			
9	...	4			
10	...	5	2		
11	...	11	5		
12	...	1	8		
13	...	10	9		
14	...	3	2		
15	...	3	1		
16	2	2	3		
17	5	...	1		
18	6	1			
19	14	...	...	1	
20	7	...	...	...	
21	19	...	...	...	1
22	8	...	...	3	1
23	2	...	...	1	...
24	2	...	...	2	1
25	1	...	...	2	2
26	...	...	...	1	1
27	...	...	...	2	1
28	...	...	...	1	1
29	...	...	...	4	...
30	...	...	...	3	...
31	...	...	...	2	...
32	...	...	...	1	2

## VENTRAL TEETH.

Number of teeth.	NUMBER OF SPECIMENS.				
	<i>P. compressa.</i>		<i>P. curvirostris.</i>	<i>P. australiensis.</i>	
	typical form.	subsp. <i>improvisa.</i>		typical form.	subsp. <i>norfolkensis.</i>
1	13	3	...	1	
2	21	25	...	2	
3	22	14	5	1	
4	4	4	17	3	1
5	3	...	7	3	3
6	3	...	1	3	2
7	...	...	...	1	1
8	...	...	1	3	1
9	...	...	...	1	
10	...	...	...	1	
11	...	...	...	1	
12	...	...	...	1	
13	...	...	...	...	
14	...	...	...	1	

In the first peraeopods (text fig. 1*a*) the carpus is comparatively slender, from 2.2 to 2.5 times as long as its greatest breadth; rarely in young specimens the proportion falls as low as 1.8. The chela is about a third longer than the carpus and its length is usually about one-third the width of the palm. The carpus of the second pair (text fig. 1*b*) is from 6.0 to 7.1 times as long as broad. The dactylus of the third peraeopods (text-figs. 1*c*, *d*) is long and slender; the propodus is only from 2.1 to 2.5 times its length. Excluding the spines its length is from 3.7 to 4.5 times its breadth. The dactylar spines vary in number from 19 to 22, very rarely 18. In the fifth peraeopods (text figs. 1*e*, *f*) the propodus is also from 2.1 to 2.5 times as long as the dactylus; the latter segment bears from 43 to 69 spinules, excluding which it is from 4.2 to 4.8 times as long as broad.

In the male the propodus of the third and fourth peraeopods is a little dilated towards the distal end and the terminal third of

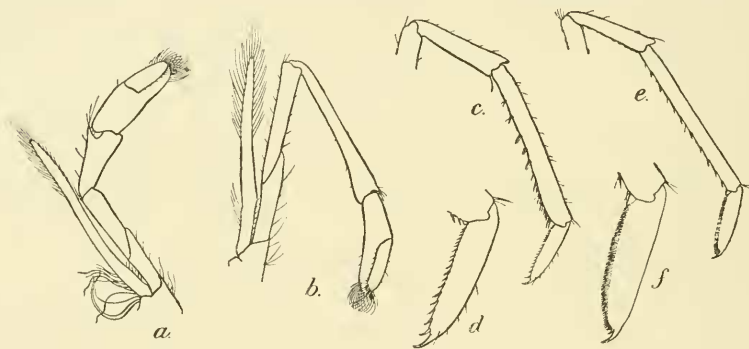


FIG. 1.—*Paratya compressa* (de Haan).

- |                             |                                 |
|-----------------------------|---------------------------------|
| a. First peraeopod.         | d. Dactylus of third peraeopod. |
| b. Second peraeopod.        | e. Fifth peraeopod.             |
| c. Third peraeopod of male. | f. Dactylus of fifth peraeopod. |

the posterior margin is armed with numerous close-set spines (text-fig. 1*c*). In the specimens I have seen these sexual modifications are much less conspicuous than in the larger individuals belonging to the subsp. *improvisa*.

None of the specimens examined bear eggs; the largest is 23 mm. in total length.

De Haan's figure of this species is unusually poor, but except for the fact that the carpus of the second legs is stated to be indistinctly annulate, the description agrees very well with the specimens I have examined. According to de Haan there are 20 to 24 teeth on the upper border of the rostrum.

The typical form of *P. compressa* is represented in the Indian Museum by a great number of specimens collected by Dr. Annandale in Komatsu Lake near the eastern shore of Lake Biwa and from the Ogura and Yodo ponds near Kyoto: there are also a few examples from L. Biwa itself. All specimens from localities situ-

ated further to the north-east belong to the subspecies *improvisa* and it appears, therefore, that the northern distributional limit of the typical form is somewhere in the vicinity of Lake Biwa. The specimens recorded by Miss Rathbun from the latter locality undoubtedly belong to the typical form and this is perhaps also the case with the solitary individuals which she examined from Tsushima I. and from Fusan in Korea. If my views on the distribution are correct, Balss' examples from Koitogawa in Kadzuza prov. are to be referred to the subsp. *improvisa*, while those recorded from Okayama belong to the typical race. Balss notes that in the latter individuals the eggs are 0.63 mm. in length and 0.40 mm. in breadth.

Dr. Ammandale noted that the species was abundant among weeds or dense vegetation at Komatsu and in pools and backwaters round Lake Biwa; in the lake itself it was much scarcer. Living specimens showed no definite markings, but were dotted more or less profusely with small pigment cells. The fingers of the chelae were tinged with orange brown. The Temnocephaloid worm *Caridinicola* was present in the gill-chambers of a large proportion of the individuals examined at Komatsu.

#### subsp. *improvisa*, nov.

1868. *Atyephyra compressa*, von Martens, *Arch. f. Naturgesch.*, XXXIV, i, p. 51, pl. i, figs. 4 a-c.

1882. *Atyephyra ? compressa*, Miers, *Ann. Mag. Nat. Hist.* (5), IX, p. 193.

? 1890. *Miersia compressa*, Ortmann, *Zool. Jahrb., Syst.*, V, p. 464.

? 1902. *Xiphocaris compressa*, Doflein, *Abhandl. math.-phys. Klasse K. Bayer. Akad. Wiss.*, XXI, p. 632.

This subspecies is distinguished from the typical form almost entirely by the dentition of the rostrum. The rostrum reaches to,

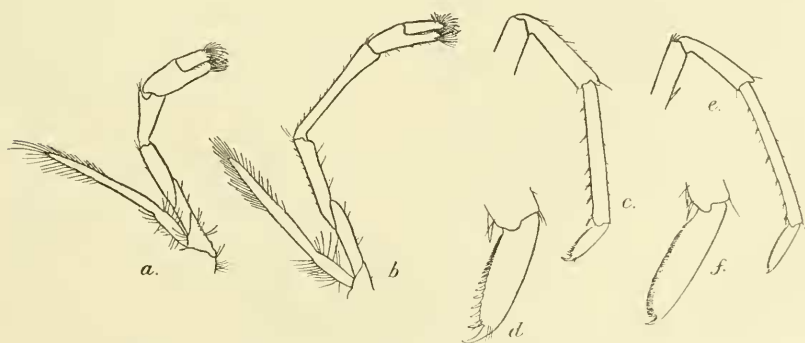


FIG. 2.—*Paratya compressa* subsp. *improvisa* nov.

a. First peraeopod.

b. Second peraeopod.

c. Third peraeopod of female.

d. Dactylus of third peraeopod of female.

e. Fifth peraeopod.

f. Dactylus of fifth peraeopod.

or a little beyond the antennal scale and bears on its upper margin an uninterrupted series of 7 to 18 (usually 8 to 15) teeth. The

proximal part of the rostrum is altogether unarmed; the hindmost tooth of the series is placed above the cornea, when the eye is directed straight forwards, or is in advance of this point. On the lower border there are from 1 to 4 teeth, usually 2 or 3.

The proportionate measurements of the legs are much the same as in the typical form. In the first pair (text-fig. 2a) the carpus is from 2.1 to 2.7 times as long as broad and in the second (text-fig. 2b) from 5.6 to 6.3 times. The propodus of the third pair (text-figs. 2c, d) is from 2.4 to 2.7 times the length of the dactylus, the length of the latter segment, spines excluded, being from 3.3 to 4.0 times its breadth. In the fifth pair (text-figs. 2e, f) the propodus is from 2.4 to (in one instance only) 2.9 times as long as the dactylus, the latter segment, spines excluded, being from 4.0 to 4.7 times as long as broad. The dactylar spines seem to be rather more numerous than in the typical form; in the third pair there are from 24 to 30 and in the fifth from 71 to 92.

In large males the third and fourth peraeopods show an extreme degree of sexual modification (text-fig. 3). The propodus is very strongly expanded distally, so much so that the segment is less than 5 times as long as broad, whereas it is nearly 9 times as long as broad in females. The anterior margin is concave, while the posterior is convex and is furnished with numerous spinules in the distal two thirds of its length. The dactylus is also modified; it is more than 5 times as long as wide and is widest near the distal end; the spines are distinctly recurved and the terminal one is not larger than the others.

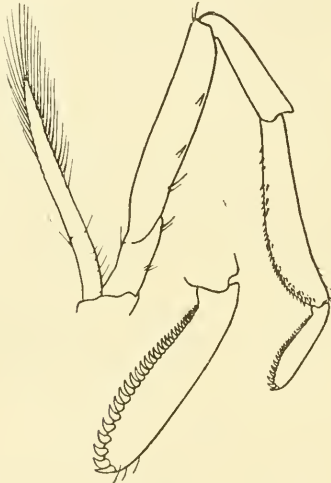


FIG. 3.—*Paratya compressa* subsp. *improvisa*, nov.

Third peraeopod of adult male with dactylus further enlarged.

length of 36 mm. The eggs vary from 0.63 to 0.70 mm. in length and from 0.43 to 0.46 mm. in breadth.

In this case I believe that the character of the rostrum affords a valid basis for racial distinction; among fifty specimens of the subspecies I have not been able to find a single individual that resembles the typical form. The specimens examined are from the lagoon Kasumi-ga-ura in Hikachi province, collected by Dr. N. Annandale; from Tokio, collected by Hilgendorf (Berlin Mus.); from Lake Haruna, near Ikao, at an altitude of about 3000 ft., collected by Dr. K. Nakazawa and from Lake Suwa, in the Shinano province, at an altitude of 2660 ft., collected by Dr. T. Kawamura.



The specimens from Yokohama described by von Martens be-long, as is clearly shown by the figure, to the subspecies *impro-visa* and this is also true of those from Tokio examined by Miers, the rostrum bearing only from 7 to 14 dorsal teeth.

From these facts it may be concluded that the subspecies is found only in the north-eastern parts of the main island of Japan and, if this is true, the specimens recorded by Ortmann from Tokio, by Doflein from Yokohama and by Balss from Koitogawa in Kadzuza province are probably to be referred to the subspecies. This is no doubt also the case with the material used by Ishikawa in his account of the development of the species.<sup>1</sup>

The types are from Lake Haruna and bear the number 9679/10 in the register of the Zoological Survey of India.

### *Paratya curvirostris* (Heller).

1862. *Caridina curvirostris*, Heller, *Verhandl. zool.-bot. Ges. Wien*, XII, p. 525.

1865. *Caridina curvirostris*, Heller, *Voy. 'Novara,' Crust.*, p. 105.

1876. *Caridina curvirostris*, Miers, *Cat. N. Zealand Crust.*, p. 78.

1879. *Leander fluviatilis*, Thomson, *Trans. N.Z. Inst.* XI, 1878, p. 231, pl. x, fig. A 2.

1903. *Xiphocaris curvirostris*, Thomson, *Trans. Linn. Soc., Zool.* (2), VIII, p. 447, pl. xxix, figs. 2-13.

1906. *Xiphocaris curvirostris*, Chilton, *Proc. Zool. Soc. London*, p. 703.

1909. *Xiphocaridina fluviatilis*, Bouvier, *Comptes rendus Acad. Sci. Paris*, p. 1728.

1912. *Xiphocaridina curvirostris*, Kemp, *Rec. Ind. Mus.*, VII, p. 113.

In this species<sup>2</sup> the rostrum reaches to or a little beyond the apex of the antennal scale and is armed above with from 10 to 17 teeth. These teeth do not form an uninterrupted series, as in all other species of *Paratya*, but are separated, usually quite distinctly, into three groups. The hindmost group consists of 2 or 3 teeth, all of which are on the carapace behind the orbital notch; the second group is composed of 4 to 8 teeth, situated in the basal half of the rostral length; the third group is placed just behind the apex and comprises 3 to 7 teeth. In most cases 1 or 2 solitary teeth are to be found between the second and third groups. On the lower margin there are from 3 to 8 teeth, usually 4 to 6. The teeth are larger than is customary and are rather widely separated, extending on to the distal third of the rostral length.

The lateral process of the antennular peduncle reaches to the middle of the second segment.

The carpus of the first peraeopods (text-fig. 4a) is from 1.7 to 2.4 times as long as broad; it is decidedly more slender in males than in females. That of the second peraeopods (text-fig. 4b) is from 5.0 to 6.7 times as long as broad. The propodus of the third peraeopods (text-figs. 4c, f) is from 2.5 to 3.9 times the length of

<sup>1</sup> Ishikawa, *Quart. Journ. Microsc. Sci.*, XXV, p. 391 (1885).

<sup>2</sup> The information here given is mostly abstracted from my paper of 1912, supplemented by a number of fresh observations.

the dactylus, the former segment being proportionately shorter in males. Excluding the spines the dactylus is 3·4 or 3·5 times as long as broad in females, rather narrower in males. In females the spines (the terminal one included) are from 9 to 11 in number, very rarely 8; in males they are more numerous, from 13 to 17, rarely 18. In the fifth peraeopods (text-figs. 4g, h) the propodus is from 3·1 to 3·7 times the length of the dactylus. The latter segment bears from 46 to 71 spinules, excluding which it is from 3·2 to 3·7 times as long as broad.

In males the propodus of the third and fourth peraeopods is modified much as in *P. compressa* (text-figs. 4e, f). The dactylus is slightly abnormal in form, but is without recurved spines and the propodus does not seem to attain as extreme a development as in large males of *P. compressa* subsp. *improvisa*. In very old females additional spinules are sometimes found on the propodi of

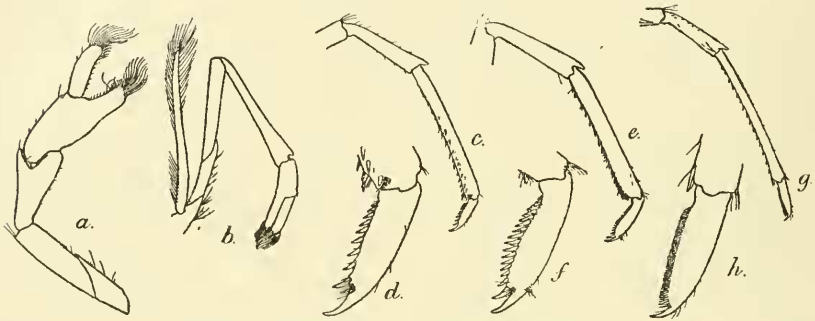


FIG. 4.—*Paratya curvirostris* (Heller).

- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| a. First peraeopod.               | e. Third peraeopod of adult male. |
| b. Second peraeopod.              | f. Dactylus further enlarged.     |
| c. Third peraeopod of old female. | g. Fifth peraeopod.               |
| d. Dactylus further enlarged.     | h. Dactylus further enlarged.     |

the third and fourth peraeopods (text-fig. 4c), thus resembling adult males.

The eggs are from 0·40 to 0·45 mm. in length and from 0·25 to 0·26 mm. in breadth. Large specimens reach a total length of 42 mm.

*P. curvirostris* is known from both north and south islands of New Zealand and from Upper Assam. It has been recorded by Chilton from the Chatham Is. In the Indian Museum it is represented by a number of specimens from the River Avon at Christchurch (Chas. Chilton coll.) and by one from the Shag River (Paris Mus.), both localities being in the southern island. There are also twenty-four specimens from Tezpur, in the Darrang district of Assam, and three from the Manipur Hills, all collected by Col. H. H. Godwin-Austen.

The views here advanced on the taxonomy of the species of *Paratya*, make it more than ever difficult to offer any explanation of the curious distribution of this species; the new observations

indicate that the methods I adopted in 1912, in comparing the specimens from Assam with those from New Zealand were reliable and that had specific differences existed they would infallibly have been detected. If the record from Assam were based on specimens from one locality I would have rejected it as untrustworthy, but the fact that samples exist from two distinct places renders it improbable that any mistake can have arisen.

***Paratya australiensis*, sp. nov.**

1894. *Miersia compressa*, Ortmann, *Fenaische Denkschrift*, VIII (=Semon's *Zool. Forschungsreis. in Australien etc.*, V), p. 10.  
 1903. *Xiphocaris compressa*, Thomson, *Trans. Linn. Soc. Zool.* (2) VIII, p. 449 (part).  
 1905. *Xiphocaris compressa*, Bouvier, *Ann. Sci. France Belgique*, XXXIX, fig. 1, p. 61.

Hitherto the Australian representative of the genus *Paratya* has been considered to be specifically identical with that from

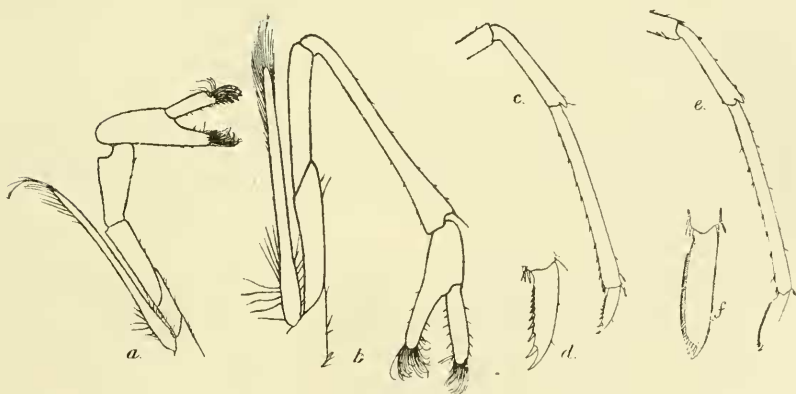


FIG. 5.—*Paratya australiensis*, sp. nov.

- |                     |                                |
|---------------------|--------------------------------|
| a. First pereopod.  | d. Dactylus of third pereopod. |
| b. Second pereopod. | e. Fifth pereopod.             |
| c. Third pereopod.  | f. Dactylus of fifth pereopod. |

Japan, but judging from the specimens in the Indian Museum it is undoubtedly distinct. Three samples of Australian specimens have been examined, all of which differ in certain well-marked features from the Japanese examples. They also differ rather considerably *inter se* and it appears not unlikely that recognisable races exist in different parts of the Australian continent. As types of *P. australiensis* I have selected a number of specimens from Clyde, near Sydney in New South Wales.

The rostrum in *P. australiensis* varies considerably in length, extending to the end of the antennular peduncle or far beyond the apex of the antennal scale, sometimes (in specimens from Sydney) reaching beyond the latter point by as much as one quarter its length. On its upper border it bears an uninterrupted series of

19 to 32 teeth<sup>1</sup> (usually 22 to 31) of which 1 or 2, rarely 3, are placed on the carapace behind the orbital notch. On the lower border there are from 1 to 14 teeth (usually 2 to 9); the distal third of the lower margin is in most cases unarmcd.

The lateral process of the antennular peduncle sometimes reaches only to the end of the basal segment, in other cases to about one-third the length of the second segment.

The carpus of the first peraeopods is comparatively slender, from 2.0 (Lake Torrens) to 2.9 times as long as broad and is sometimes, as shown in text-fig. 5*a*, much less deeply excavate than in other species. The carpus of the second pair (text-fig. 5*b*) is from 5.8 to 7.5 times as long as broad. The propodus of the third pair (text-fig. 5*c*) is from 3.5 to 4.0<sup>2</sup> times as long as the dactylus (terminal spine included). The dactylus (text-fig. 5*d*) bears from 9 to 13 spines, usually 9 to 11; excluding these its length is from 3.0 to 3.6 times its breadth. In the fifth peraeopods (text-figs. 5*e*, *f*) the propodus is from 3.0 to (rarely) 3.8 times the length of the dactylus. The latter segment, spinules excluded, is very variable in form, from 3.3 to nearly 5<sup>3</sup> times as long as wide. The spinules vary in number from 28 to 82.<sup>4</sup>

The third and fourth legs of the male show no signs of sexual modification.

No ovigerous females are present in the material examined. The largest of the Sydney specimens is 27 mm. in length; an individual from "S. Australian waters" is rather larger, about 31 mm.

The specimens examined are from Clyde, near Sydney, from Lake Torrens in S. Australia and from "S. Australian waters." The first of these samples includes the type specimens<sup>5</sup> which bear the number 7590-2/10 in the Zoological Survey register. The specimens recorded by Ortmann from Burnett in Queensland, by Bouvier from Melbourne and by Thomson from Victoria and New South Wales are presumably to be referred to this species. The identity of von Martens' examples from Adenare near Flores is quite uncertain.

The material I have examined shows an unusually great range of variation and it is possible, as noted above, that more than one definable race of the species exists in Australia; the specimens in my hands are, however, not sufficiently numerous to afford evidence that this is really the case.

<sup>1</sup> The rostral formulae in the three samples are as follows:—In 12 specs. from Sydney  $\frac{25.39}{5.14}$ ; in 6 specs. from Lake Torrens  $\frac{22.29}{3.8}$ ; in 5 specs. from "S. Australian waters"  $\frac{19.30}{1.5}$ .

<sup>2</sup> In a female from Lake Torrens.

<sup>3</sup> 3.3 to 4.0 in most cases. The specimen with a proportion of nearly 5 is perhaps an abnormality.

<sup>4</sup> From 28 to 65 in the Sydney specimens.

<sup>5</sup> Owing to a very unfortunate accident the types have been destroyed since the description was drawn up. The only portions of them that remain are certain appendages mounted on slides for microscopic examination.



subsp. *norfolkensis*, nov.

1903. *Xiphocaris compressa*, Thomson, *Trans. Linn. Soc. Zool.* (2) VIII, p. 449 (part).

1907. *Xiphocaris compressa*, Grant and McCulloch, *Proc. Linn. Soc. N.S.W.*, XXXII, p. 156.

Specimens from both sides of Norfolk I., collected by Messrs. Laing, are in the Indian Museum. Examples from the east side of the island are smaller than those from the west, but do not appear to be distinguished by any other constant character. The material examined does not bear out Grant and McCulloch's statement that the rostrum is proportionately shorter in specimens from the east side.

The rostrum varies greatly in length and is frequently very



FIG. 6.—*Paratya australiensis* subsp. *norfolkensis*, nov.

a. First peraeopod.

b. Second peraeopod.

c. Third peraeopod.

d. Dactylus of third peraeopod.

e. Fifth peraeopod.

f. Dactylus of fifth peraeopod.

much shorter than in any other race of *Paratya*. In specimens from the west side it reaches, in one instance, only to the end of the second antennular segment, in others almost or quite to the end of the peduncle and in one individual a little beyond the apex of the scale. Among those from the east side the rostrum in one case reaches barely beyond the end of the first antennular segment, in others to the end of the second segment, to the end of the peduncle or a trifle beyond the apex of the scale. The upper border bears from 21 to 32 teeth,<sup>1</sup> forming an uninterrupted series from the base to the apex. The hindmost 2 to 5 teeth<sup>2</sup> are placed on the carapace. On the lower border there are from 3 to 8 teeth<sup>1</sup> which almost always extend on to the distal third of the rostral length and not infrequently reach almost to the apex.

<sup>1</sup> According to Thomson's observations the teeth vary from 17 to 34 above and from 2 to 9 below.

<sup>2</sup> 2 or 3, rarely 4, in specimens from the east side; 4, rarely 5, in those from the west.

The lateral process of the antennular peduncle reaches to the end of the basal segment, or as far as the middle of the second segment.

The carpus of the first peraeopods (text-fig. 6*a*) is much broader than in any other race or species of *Paratya* that I have seen; in females it is only from 1.3 to 1.6 times as long as broad and in males from 1.7 to 1.9 times. It is very deeply excavate anteriorly. The carpus of the second peraeopods (text-fig. 6*b*) is from 4.2 to 4.9 times as long as broad. In the third peraeopods (text-figs. 6*c*, *d*) the propodus, in females, is from 4.3 to 5.2 times as long as the dactylus, from 3.7 to 3.9 times in males. Excluding the spines the dactylus is only from 2.1 to 2.7 times as long as broad, being rather more slender in males than in females. The spines are less numerous than in the typical form; they vary from 6 to 8, the number occasionally rising to 9 in males. In the fifth peraeopods (text-figs. 6*e*, *f*) the propodus is from 4.2 to 4.4 times as long as the dactylus, the proportion in males rarely falling to 3.9. The dactylus, excluding the spinules, is from 2.4 to 2.8 times as long as broad. The spinules are from 35 to 43 in number and differ conspicuously from those of the typical form in one particular. In the Australian race, as in all other members of the genus save the present one, the spinules towards the apex increase successively in size by even gradations. In the Norfolk I. form the spinules are fine and regular throughout the greater part of the dactylar length, but close behind the tip there is a sudden break in continuity, the three, less commonly two terminal teeth being vastly larger than the adjacent members of the series (text-fig. 6*f*).

As in the typical form the third and fourth legs of the male show no signs of sexual modification.

There are no ovigerous females among the specimens examined. Examples from the west side of the island reach a length of 32 mm.; those from the east side do not exceed 18 mm.

It appears to me not improbable that the Norfolk I. form deserves rank as a full species, but further work on the Australian races is necessary before its precise position can be determined.

The types are from the west side of the island and bear the number 8500/10 in the register of the Zoological Survey of India.

